

A NEW SPECIES OF *EUTARSOPOLIPUS* BERLESE
(ACARI: PODAPOLIPIDAE) FROM THE GALAPAGOS ISLANDS, A
PARASITE OF *AGONUM CHATHAMI* VAN DYKE
(COLEOPTERA: CARABIDAE)

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Abstract.—*Eutarsopolipus brettae*, n. sp. (Acari: Podapolipidae), is described from *Agonum chathamii* Van Dyke (Coleoptera: Carabidae) from the Galapagos Islands and compared with related species of *Eutarsopolipus*. Characters of *E. brettae* do not fit with existing subgroups of *Eutarsopolipus*.

Key Words: beetle, Carabidae, parasitic mites, Acari, Podapolipidae, Galapagos, Ecuador

Mites in the family Podapolipidae (Acari: Heterostigmata) are highly specialized ecto- and endoparasites of the insect orders Blattaria, Orthoptera, Heteroptera, Hymenoptera, and especially Coleoptera. The genus *Eutarsopolipus* Berlese is restricted to hosts in Carabidae (Coleoptera) and occurs worldwide. Along with the type species, *E. lagenaeformis* Berlese 1913, more than 40 others have been discovered, of which 21 were described by Regenfuss (1968, 1974). This is the first record of *Eutarsopolipus* from the Galapagos Islands.

The purpose of this paper is to describe a new species collected from *Agonum chathamii* Van Dyke and compare it with other species of *Eutarsopolipus* parasitizing the carabid genus *Agonum*, with *Eutarsopolipus* from Central and South America, and with related *Eutarsopolipus* worldwide.

MATERIALS AND METHODS

Males, larval and adult females, and eggs of *Eutarsopolipus brettae* were collected from *Agonum chathamii* Van Dyke borrowed from the California Academy of Sciences, San Francisco, California, U.S.A. The technique for removing mites from mu-

seum specimens is described in Husband and Dastych (1998).

Measurements, in micrometers (μm), were taken with the aid of a Zeiss microscope with a stage micrometer and drawing tube. The terminology used follows Lindquist (1986).

Eutarsopolipus brettae Husband, new species (Figs. 1–3)

Diagnosis.—Adult female *E. brettae* lack stigmata, cheliceral stylets are long, 75–85, and ambulacral II, III claws are well developed (10). The genital capsule of male *E. brettae* has concave lateral margins. Plates C and D are separate in larval female *E. brettae*, cheliceral stylets are long (60–64), setae of the idiosoma and legs are long (Table 1), and the larval female has 3 femur I setae in combination with 1 genu I seta (Table 2).

Adult female (Fig. 1).—*Gnathosoma:* Length 62–69, width 60–67. Palp length 22–25; cheliceral stylet length 75–85 with basal sclerite 12–15, pharynx width 17, walls of pharynx thick, dorsal gnathosomal

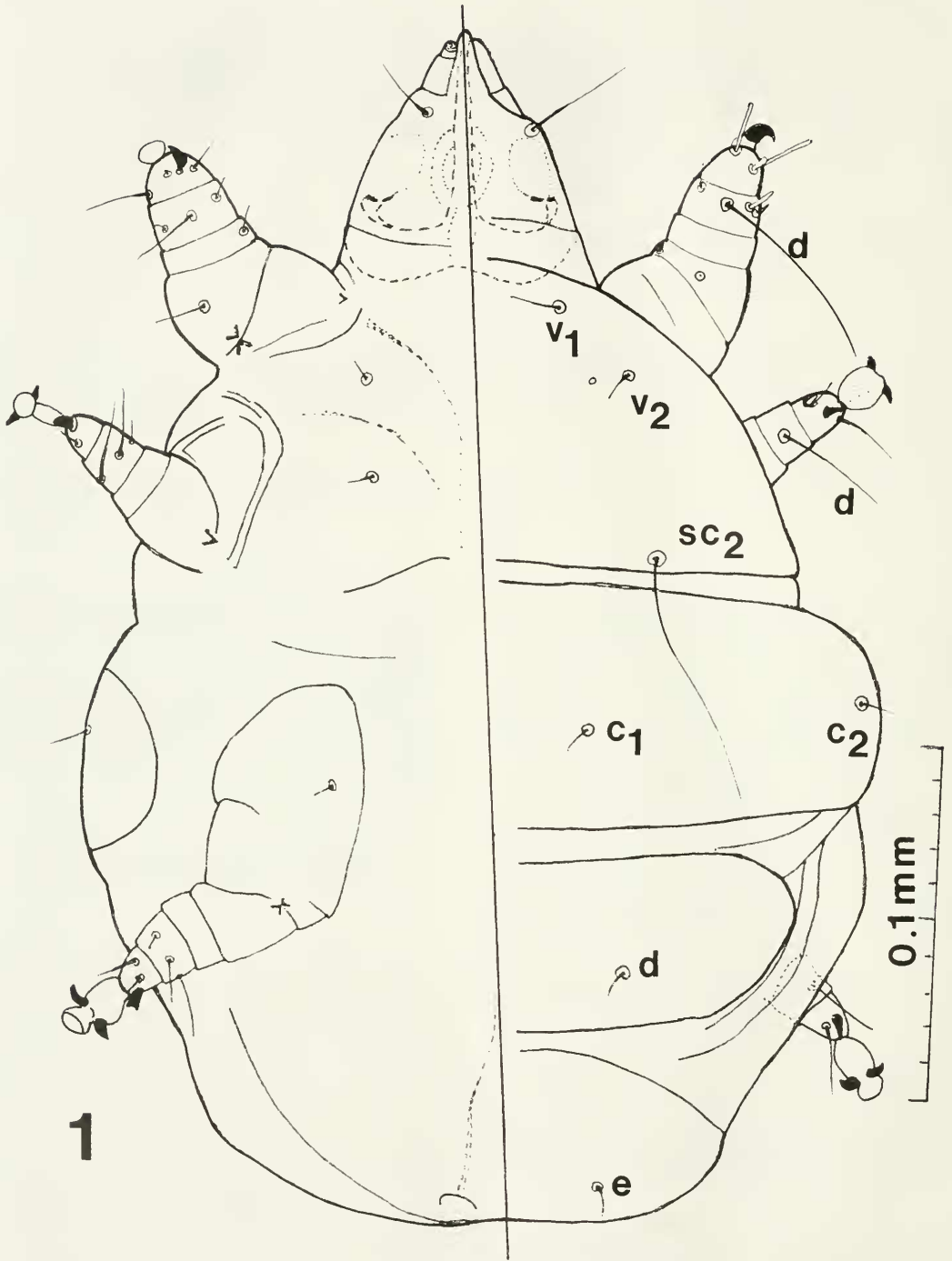


Fig. 1. *Eutarsopolipus brettae*, adult female: left, ventral aspect; right, dorsal aspect.

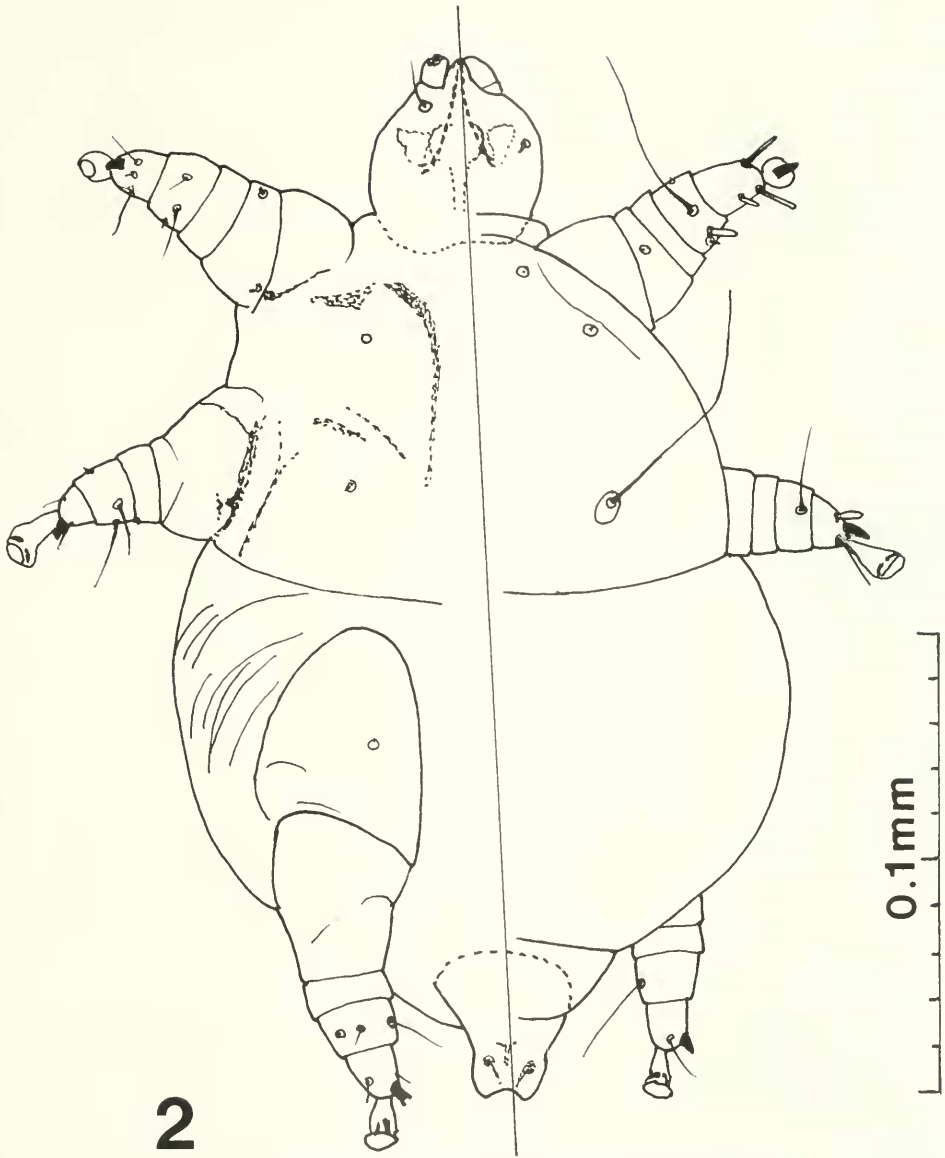


Fig. 2. *Eutarsopolipus brettae*, adult male: left, ventral aspect; right, dorsal aspect.

setae 32–35, ventral setae 20–25, distance between ventral setae 18–20. No stigmata.

Idiosoma: Length 266–450, width 209–318. Prodorsal plate setae v_1 12–15 v_2 7–8, sc_2 25–30, setae about 10 from posterior margin of prodorsal plate. Distance between setae v_1 55–56; v_2 lateral to line connecting v_1 and sc_2 . Plate C midlength 60–70, width 237–265, setae c_1 7–8, c_2 9–10. Plate D length 50–75, width 175–197, setae

d 7–8. Plate EF length 40–53, width 130–145, setae e 7–8, no setae h_1 , h_2 .

Venter: Apodemes 1 and 2 weakly developed, meeting sternal apodeme medially; sternal apodeme not extending beyond junction with apodemes 2. Coxal setae $1a$ 3–4, $2a$ 5–6; setae $1a$ situated equidistant to apodemes 1, 2. Distance between setae $1a$ 37–52. Coxal setae $3a$ not evident, $3b$ 6–7.

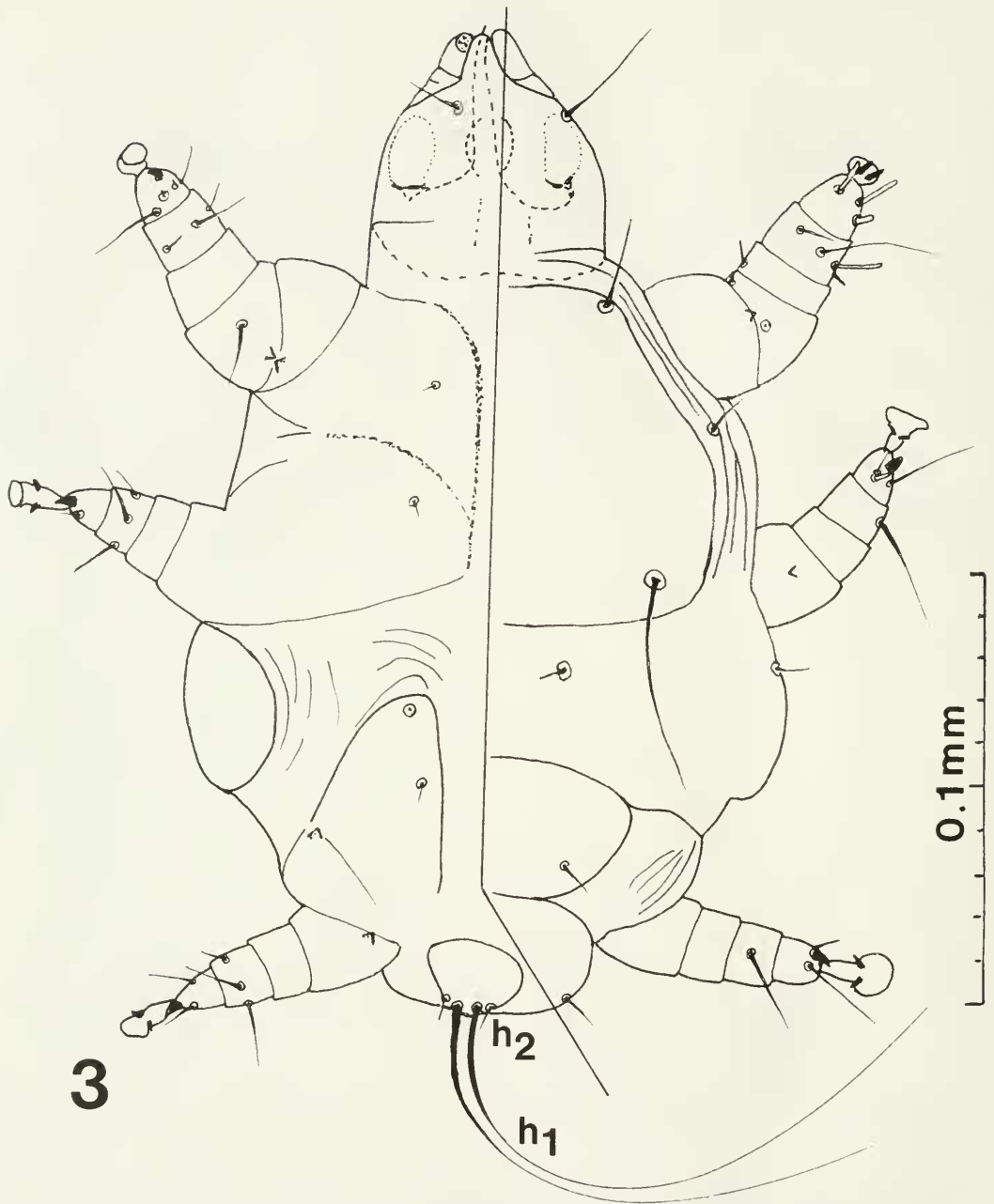


Fig. 3. *Eutarsopolipus brettae*, larval female: left, ventral aspect; right, dorsal aspect.

Legs: Leg setation as in Table 2. Ambulacrum I with a terminal stout claw, ambulacra II, III with 2 strong claws. Tarsus I subunguinal seta spinelike, 2 terminal spines on each of tarsi II, III. Tarsus I solenidion ω 5–6; tarsus II solenidion ω 5.

Tibia I solenidion ϕ 8–9, adjacent seta k 4–6. Tibial I, II, III setae d 45–50, 30–33 and 20–22 respectively.

Male (Fig. 2).—*Gnathosoma:* length 37–40, width 36–37. Palp length 13–17; cheliceral stylet length 25–31, no basal

sclerite; pharynx width 10–11, dorsal gnathosomal setae thick 2–4, ventral setae 9–13.

Idiosoma: Length 170–188, width 120–147. Prodorsal setae v_1 m, v_2 m, setae sc_2 53–65. Distance between setae v_1 20–21, distance between setae v_2 52; setae v_2 lateral to line connecting setae v_1 and sc_2 . Plates C and D fused, setae c_1 , v_2 , d , and e vestigial or not present. Genital capsule length 28–30, width 30–35 at base, concave lateral margins.

Venter: Apodemes 1, 2 and sternal apodeme evident; coxae III separated medially. Setae *1a*, *2a*, *3b* microsetae, *3a* not evident.

Legs: Leg setation as in Table 2. Ambulacrum I with 1 thick claw, length 4, ambulacra II, III with small claws 3. Tarsus I spinelike seta s 5–6, tarsi II, III spinelike setae tc' and u' 5–7. Tarsus I solenidion ω 5–6, tarsus II solenidion ω 4–5; tibia I solenidion ϕ 8, adjacent seta k 2–3. Tibiae I, II, III setae d 30–33, 15–22, 19 respectively. Genu III seta v'' evident in only I male.

Larval female (Fig. 3).—*Gnathosoma*: length 44–53, width 42–45. Palp length 15–20, cheliceral stylet length 60–64, stylet basal sclerite 7–8, pharynx width 12–13, dorsal gnathosomal setae 31–36, ventral setae 13–14, distance between ventral setae 14–20.

Idiosoma: Length 165–192, width 125–132. Prodorsal plate setae v_1 17–20, v_2 9–16, sc_2 84–85. Distance between setae v_1 34–45; setae v_2 lateral to line connecting setae v_1 and setae sc_2 . Plates C and D separate, setae c_1 7–8, c_2 8–10, setae d 7–8; distance between setae d 30–33. Setae c_2 in line with setae c_1 . Plate EF oval, setae e 7. Plate H broader at base, setae h_1 80–90, h_2 5–7, distance between setae h_1 2.

Venter: Apodemes 1, 2 and sternal apodeme conspicuous but weakly sclerotized. Setae *1a* 3–4, *2a* 3–5, *3a* m and *3b* 5. Distance between setae *3a* and *3b* 18–20, setae *3a* visible only in larval exoskeleton associated with adult female.

Legs: Leg setation as in Table 1. Ambulacrum I with 2 small, parallel claws.

Ambulacra II, III with small, diverging claws. Tarsus I spinelike seta s 5, tarsi II, III spinelike setae tc' and u' 5–7. Tarsus I solenidia ω 3–5, tarsus II solenidion ω 5. Tibia I solenidion ϕ 9–10, seta k 3. Setae tc' 7–9, tc'' 9–10. Tibiae I, II, III setae d 35–40, 18–23 and 17–25 respectively.

Egg.—Length 210–240, width 120–135.

Type, host, and locality data.—Holotype ♀ (RWH010501-1), allotype ♂ and 24 paratypes: from Chatham Island, Galapagos Islands, Ecuador, from under elytra of *Agonum chathamii* Van Dyke (Carabidae) collected by F. S. Williams, 3 October 1905.

Type deposition.—Holotype, allotype, 9 adult ♀ paratypes, 6 ♂ paratypes, 3 larval ♀ paratypes and 2 egg paratypes of *Eutarsopolipus brettiae* deposited in the Department of Entomology, California Academy of Sciences, San Francisco, California, U.S.A. One ♂, 2 adult ♀, 1 larval ♀ and 1 vial of paratypes in the collection of the author.

Etymology.—The species is named for Roberta Brett, California Academy of Sciences, San Francisco, California, in recognition of her support of studies of parasitic mites of insects.

DISCUSSION

Before Regenfuss (1968) described 16 new species of *Eutarsopolipus* from Germany, only *E. lagenaeformis* from Italy and *E. desani* Cooreman 1952 from Central Africa were known. Regenfuss (1968) defined 7 subgroups of *Eutarsopolipus*. As new species were described from Pacific Islands, Australia, India, S. Africa, and the Western Hemisphere, characters of existing subgroups of *Eutarsopolipus* no longer worked in placing new species. Husband (1995) created the *ochoai* subgroup and Husband and Macfarlane (1999) created the *catadromi* and *secundus* subgroups. There are now more than 40 species of *Eutarsopolipus* and many more expected from the more than 25,000 known species of Carabidae.

Major characters used to distinguish subgroups of *Eutarsopolipus* include: presence

Table 1. Comparisons of characters and maximum measurements of *Eutarsopolipus brettae* with *Eutarsopolipus* species in the *pterostichi* and *agonum* groups, *E. trichognathi* from South America and *E. ochoai* from Central America.

Character	<i>E. brettae</i>	<i>pterostichi</i>	<i>agonum</i>	<i>E. trichognathi</i>	<i>E. ochoai</i>
Adult females					
Stigmata	0	0	+	+	+
Idiosoma	450	510	498	550	580
Amb. II, III claws	10	17	0	0	3, thin
Cheliceral stylets	85	48	40	54	67
Dors. gnath. setae	35	19	20	18	29
Vent. gnath. setae	25	6	5	5	25
Setae v_1	15	6	9	5	23
Setae v_2	8	9	20	5	18
Femur I v''	19	m	0	0	20
Tibia I sol. ϕ	9	10	4	7	9
Tibia II d	33	10	15	8	31
Genu I v'	5	2	0	0	4
Adult males					
Idiosoma	188	220	196	173	222
Amb. II, III claws	5	minute	0	minute	3, thin
Cheliceral stylets	31	28	22	23	31
Dors. gnath. setae	4, thick	13	7	8	13
Vent. gnath. setae	13	4	m	m	9
Setae sc_2	65	48	37	32	62
Femur I v''	0-12	2	0	0	0
Tibia I d	33	19	13	27	31
Larval females					
Idiosoma	192	270	230	332	217
Amb. II, III claws	4	minute	0	minute	3, thin
Cheliceral stylets	64	49	29	32	49
Dors. gnath. setae	36	30	16	16	26
Vent. gnath. setae	14	7	5	m	15
Femur I v''	14	m	0	0	10
Tibia I d	40	8	18	10	26
Tarsus II sol. ω	5	2	0	5	5
h_1-h_1 distance	2	7	12	4	0, adj.
h_2	7	22	30	25	m
Genu I v_2	0	0	0	0	5

or absence of stigmata, shape of the male genital capsule, proportions of cheliceral stylets in relation to gnathosoma, presence or absence of idiosomal setae or setae on legs and presence or absence of idiosomal plates. Major characters used to distinguish species include: relative lengths of cheliceral stylets, lengths and widths of other structures, idiosomal plates of adult females divided or not, plates of larval females fused or not, idiosomal shape, structure of setae (thick, thin, with or without micro-

spines), setal position, and relatives lengths and position of setae of the legs and idiosoma.

All *Eutarsopolipus* that are parasites of the carabid genus *Agonum* fit patterns described for the *biunguis* subgroup proposed by Regenfuss (1968). Comparisons of *Eutarsopolipus brettae* with species in the *biunguis* group yielded more than 40 differences. All *biunguis* species have distinct stigmata, no ambulacral I claw, no or minute ambulacra II, III claws, no femur I se-

Table 2. Leg setation of femur, genu, tibia and tarsus for larval female *E. brettae* and related species. Solenidia are included. Two numbers in a column indicate variation in setal numbers.

	Leg I				Leg II				Leg III			
	F	G	Ti	Ta	F	G	Ti	Ta	F	G	Ti	Ta
<i>E. brettae</i>	3	1	7	7	0	1	4	6	0	1	4	5
<i>E. ochoai</i>	3	2	7	9	0	1	4	7	0	1	4	5
<i>E. stammeri</i>	0	2	6	9	0	1	4	6	0	1	4	5
<i>E. trichognathi</i>	2	0	7	8/9	0	0	4	6	0	0	4	5
<i>E. biunguis</i> subgroup												
from <i>Agoum</i>	1/2	0	7	8	0	0	4	5	0	0	4	5
<i>E. lukoschusi</i>	3	0	6	9	0	0	4	6	0	0	4	5
<i>E. pterostichi</i> subgroup	2/3	0/2	5/7	8/9	0	0	4	6/7	0	0	4	5/6

tae v'' and no genu I v'' setae. *Eutarsopolipis brettae* has no stigmata and has the structures which are missing in *biunguis* species. Patterns of characters do not fit patterns for the *biunguis* subgroup, any of the other 6 subgroups proposed by Regenfuss or any of the 3 subgroups added since 1968.

An attempt was made to place *E. brettae* with species which have no stigmata: *E. stammeri* Regenfuss of the *stammeri* subgroup, *E. lukoschusi* Husband 1986 and species in the *pterostichi* subgroup. In contrast to large claws of female *E. brettae*, no claws are present in *E. stammeri*. In *E. lukoschusi* ambulacral claws II, III are minute and ambulacrum I claw is small. Regenfuss (1974) placed *E. inermis* Regenfuss from Georgia, U.S.A., within the *pterostichi* subgroup because it lacked stigmata, the genital capsule of the male was similar to other mites in this group, solenidia were short as was femur I seta d and larval females had slightly separated setae h_1 . In contrast to other mites in the *pterostichi* subgroup, adult females of *E. inermis* have no genu I setae, all ambulacral claws are reduced and coxal seta $3a$ setae are not present. The holotype of *E. pterostichi* Regenfuss has 3 femur I setae (as does *E. brettae*), 2 genu I setae in contrast to 1 genu I setae in *E. brettae*, and short solenidia ω in contrast to longer solenidia ω on tarsi I, II in *E. brettae*. Setae h_1 are nearly adjacent in larval female *E. brettae* and genital capsules of males have concave rather than straight lateral

margins. Although adult female *E. brettae* do not appear to have setae $3a$, ambulacral claws are not reduced as in *E. inermis*. With the exception of *E. inermis* in the *pterostichi* subgroup, cheliceral stylets of all instars of *E. brettae* are distinctly longer (Table 1).

Geographically, the nearest *Eutarsopolipus* species to *E. brettae* are *E. ochoai* Husband 1995 parasite of *Pasimachus* spp. beetles from Costa Rica and *E. trichognathi* Husband and Eidelberg 1996 from *Trichognathus marginipennis* (Latreille) from Brazil. The species *E. trichognathi* occurs in Ecuador, Columbia, Brazil, Paraguay and Bolivia (Husband 1999). In contrast to no stigmata in *E. brettae*, both *E. ochoai* and *E. trichognathi* have stigmata. *Eutarsopolipus trichognathi* shares characters with the *biunguis* subgroup of *Eutarsopolipus*. All instars of *E. ochoai* have small ambulacra II, III claws in contrast to larger claws in *E. brettae*. Genu I of *E. ochoai* has 2 setae in contrast to 1 seta of *E. brettae*. Males of *E. brettae* have short, thick dorsal gnathosomal setae (4) in contrast to longer gnathosomal setae (13) in males of *E. ochoai*. I consider, on the basis of these characters, that *E. brettae* is not closely related to the 2 species of *Eutarsopolipus* from Central and South America.

Until a reassessment of subgroups of *Eutarsopolipus* is completed, *E. brettae* cannot be placed in a subgroup. It has combinations of unique characters of no other *Eutarsopolipus*.

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LITERATURE CITED

- Berlese, A. 1913. Acari Nuovi. Redia 9: 27-87.
- Cooreman, J. 1952. Acariens Podapolipodidae du Congo Belge. Bulletin Institut de l'Institute Royal des Sciences Naturelles de Belgique 28(35): 1-10.
- Husband, R. W. 1986. New taxa of Podapolipidae (Acarina) from S. African Coleoptera: Result of the Namaqualand-Namibia expedition of the King Leopold Foundation for exploration and protection of nature. Bulletin de l'Institut Royal des Sciences Naturelles de Belgique: Entomologie 56: 5-14.
- . 1995. A new species of *Eutarsopolipus* (Acari: Podapolipidae) from Costa Rican *Pasimachus* spp. (Coleoptera: Carabidae). Entomologischen Mitteilungen aus dem Zoologische Museum Hamburg 11(151): 157-165.
- . 1999. American *Eutarsopolipus* of the *biunguis* group and descriptions of previously unknown male and larval female of *Eutarsopolipus trichognathi* (Acari: Podapolipidae) from South America. International Journal of Acarology 25(1): 13-17.
- Husband, R. W. and H. Dastych. 1998. A new species of *Eutarsopolipus* (Acari: Podapolipidae) from *Chlaenius sericeus* Frost (Coleoptera: Carabidae) from Athens, Georgia, U.S.A. Entomologischen Mitteilungen aus dem Zoologische Museum Hamburg 12(158): 317-326.
- Husband, R. W. and M. Eidelberg. 1996. A new species of *Eutarsopolipus* (Acari: Podapolipidae) from *Trichognathus marginipennis* (Coleoptera: Carabidae) from Brazil. International Journal of Acarology 22(3): 193-197.
- Husband, R. W. and D. Macfarlane. 1999. Two new species of *Eutarsopolipus* (Acari: Podapolipidae) from *Catadromus lacordairei* (Coleoptera: Carabidae) from Australia. International Journal of Acarology 25(4): 297-308.
- Lindquist, E. E. 1986. The world genera Tarsonemidae (Acari: Heterostigmata): A morphological, phylogenetic, and systematic revision with reclassification of family group taxa in Heterostigmata. Memoirs of the Entomological Society of Canada 136: 1-517.
- Regenfuss, H. 1968. Untersuchungen zur Morphologie, Systematik und Ökologie der Podapolipidae (Acarina, Tarsonemini). Zeitschrift für Wissenschaftliche Zoologie, Leipzig 177(3/4): 183-282.
- . 1974. Neue ektoparasitische Arten der familie Podapolipidae (Acari: Tarsonemini) von Carabiden. Mitteilungen aus dem Hamburg Zoolische Museum und Institut 71: 147-163.